SIMPLE TOOL FOR ANNUAL ESCALATING (AND DE-ESCALATING) INFRASTRUCTURE VALUE BASED ON THE CONSTRUCTION PRICE ADJUSTMENT FACTOR

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ABSTRACT

Municipalities are under a legislative imperative to compile asset registers that account for all their assets and provide accurate annual valuations of their assets, in particular their infrastructure assets. It is also considered best practice for municipalities to prepare infrastructure asset management plans. The need to value infrastructure assets and specifically to determine the asset current replacement cost has increased significantly in the recent past. The determination of asset replacement cost would ideally be determined from historic cost data at every instance. However, given the lack of historic cost data and the effort required to collect and analyse this data, it is often more effective to extrapolate the value from previous estimates with the allowance for a suitable escalation that is more representative than the global Consumer Price Index (CPI) within the municipal infrastructure/finance sphere. This paper presents a simple tool that was developed to escalate and deescalate infrastructure values based on the various Contract Price Adjustment Factors.

INTRODUCTION

Municipalities in general are infrastructure intensive organisations that are dependent on their infrastructure assets to deliver the services required to meet the needs of the people in the communities they serve. In order to effectively manage their infrastructure, Municipalities need to have a good understanding of the value of their assets. This is important for service delivery as the value of the infrastructure assets tends to form the basis for determining the operations and maintenance budgets which directly contributes to the levels of service that the municipality can provide through their infrastructure.

Under the Municipal Finance Management Act of 1999 No.56 of 2003, municipalities are required to account for their assets in compliance with Generally Recognised Accounting Practice (GRAP). Most municipalities provide services to their communities by means of their infrastructure assets that account for the largest portion of the value of all their assets on their balance sheet, which is prepared as part of the annual financial statements that are audited by the Auditor General. Where depreciated replacement cost is used as a valuation methodology, the determination of the current replacement cost is a critical step in the valuation. The determination of the current replacement cost is also essential for the preparation of asset management plans that have been advocated as best practice in South Africa.

The challenge with valuing infrastructure assets lies in the availability, or more accurately, in the lack of availability of accurate costing data for the broad spectrum of infrastructure assets that are typically owned by municipalities. Ideally, first principal modelling could be utilised to determine the valuation of infrastructure assets, but the time and data requirements for implementing this approach are onerous which tends to make the costs associated with this approach prohibitive. Unfortunately there is no national database or methodology in place that can assist with the provision of accurate infrastructure asset valuations. In many cases infrastructure asset valuation data or the unit rates derived from pre-existing infrastructure costing data that is available tends be historic. This presents a challenge in terms of the alignment between the age of the valuation data and the age of the infrastructure being evaluated, due to the effect of inflation on the buying power of money.

There are several measures or inflation rates that can be utilised to reflect this erosion in the purchasing power of money. The most commonly used measure for price inflation is the Consumer Price Index (CPI) which is usually calculated as a measure of the average change over time in the prices paid by urban consumers for a market based basket of consumer goods and services. Another measure is the Producer Price Index (PPI) which measures the average change in prices received by domestic producers for their output. However, since municipal infrastructure is created through civil engineering works, the infrastructure will be not representative of the typical goods and services that an average 'urban consumer' uses nor the average price of the national produce output. Thus, using the CPI or PPI as measures for determining the value of municipal infrastructure is not ideal as these indices will not be representative of the civil engineering construction industry.

This paper outlines an approach for utilising the Contract Price Adjustment formula, that is used in the construction industry and in particular in civil engineering construction to compensate contractors for the escalation in costs over time, for escalating and de-escalating the value of municipal infrastructure assets. As the Contract Price Adjustment (CPA) is widely accepted in the civil engineering construction industry and is an effective measure of cost escalation (i.e. inflation), it would thus provide a more representative measure of the expected escalation and de-escalation in costs of municipal infrastructure. The approach presented in this paper provides a tool that can be used to update infrastructure values based on a rational assessment of data provided by the South African Statistical Service that avoids the huge costs associated with maintaining and updating a database of infrastructure costs and without having to go back to first principles every year.

2. APPROACH

2.1 Introduction

Most engineering construction based contracts contain provisions for adjustments to changes in cost (i.e. price escalation) utilising a price adjustment formula to take into account the increases or decreases in the costs of labour, equipment, plant, material and fuel over the period of the contract. It is the general practice that the client of the works specifies the exact formula that is used for the contract; however standard formulae for determining the escalation have been developed, in South Africa by: the South African Institution of Civil Engineering (SAICE), South African Federation of Engineering Contractors (SAFCEC) and the Steel and Engineering Industries Federation of South Africa (SEIFSA), and internationally by the FédérationInternationale Des Ingénieurs-Conseils (FIDIC), French for the International Federation of Consulting Engineers.

The approach followed in this paper utilises the formula developed by the SAICE for determining the price escalation for construction works.

2.2 The Formula

The formula accepted and approved for inclusion in the General Conditions of Contract for Construction Works (SAICE 2010), is based on the Haylett Formula for escalation, which has been adopted by the industry and it has been accepted by SAICE, Construction Industry Development Board (CIDB) and SAFCEC. The expression utilised by SAICE to calculate the Contract Price Adjustment Factor (fCPA), is presented in Equation 1.

(1) Where:

- "x" is the proportion of the contract value that is not subject to adjustment (i.e. the fixed portion), and unless stated otherwise in the contract the fixed proportion will be 0.10 or 10%. Thus the portion that will be subject to adjustment is 0.9 or 90% of the contract/claim value.
- "a", "b", "c" and "d" are the coefficients contained in the contract which are deemed, irrespective of the actual constituents of the work, to be representative of the proportionate value of labour, contractor's equipment, materials (excluding specialist materials which must be separately stipulated in the contract) and fuel respectively. The arithmetical sum of "a", "b", "c" and "d" must be equal to unity. Thus these coefficients are effectively weighting factors that account for the proportion of the labour, plant, material and fuel values of the construction works being carried out.
- "L" is the Labour Index, the value for which is taken as the CPI for labour in the province where the work is to be carried out as published by Statistics South Africa (Stats SA) in their Statistical News Release P0141.1.
- "P" is the Plant Index, the value for which will be taken as the Producer Price Index for Civil Engineering Plant as published by Stats SA in Table 12 of their Statistical News Release P0142.1.
- "M" is the Materials Index, the value for which will be taken as the Civil Engineering Producer Price Index for materials as published by Stats SA in Table 11 of their Statistical News Release P0142.1.
- "F" is the Fuel Index, the value for which will be taken as the Producer Price Index for Diesel at wholesale level for the area where the contract is being carried out as published by Stats SA in Table 12 of their Statistical News Release P0142.1.

For "L", "P", "M" and "F" the suffix "o" denotes the base indices applicable to the base time frame (month or year) that will be utilised in the determination of the fCPA, and the suffix "t" denotes the current indices applicable to the future time frame (month or year) that will be utilised in the determination of the fCPA.

The price adjustment amount is determined by multiplying the original applicable/relevant amount by the fCPA. In summary the expression in Equation 1 provides a multiplication factor to adjust what the contractor is paid for, to reasonably account for the effects of inflation that occur within in the civil engineering construction industry over the period of the contract. Hence the formula in Equation 1 provides an effective inflation adjustment mechanism for the civil engineering construction industry that can be calculated based on published CPI and PPI indices that are germane to the civil engineering construction industry. Considering that the current replacement cost value of any given municipal asset needs to be representative of the cost that would be incurred if that same asset had to be constructed in the same location to provide the same service, utilising the CPA to determine the escalation in value of municipal assets due to inflation would provide a more representative measure than simply scaling the municipal asset value by CPI or PPI rate. Utilising the fCPA, in Equation 1 it is thus possible to determine the multiplication factor (i.e. the percentage change) for adjusting the value of municipal infrastructure to accommodate for inflation.

3. METHODOLOGY

3.1 Introduction

In this methodology the Haylett Formula as adopted by SAICE for determining the CPA was used to calculate the fCPA, for the municipal financial year from 2001/02 to 2011/12. However in order to use the expression in Equation 1, the required indices data for the Labour Index, the Plant Index, the Materials Index, the Fuel Index along with the weighting coefficients (for labour, contractor's equipment, materials and fuel) must first be determined. This section details how each of the required indices and coefficients are determined, then utilised to calculate the CPA.

3.2 The Indices

3.2.1 Introduction

The indices for the Labour Index, Plant Index, Materials Index and Fuel Index are taken from the Statistical News Releases P0141 and P01421, which published by Stats SA on a monthly basis (Stats SA 2012).

The first consideration that needs to be taken into account is that Stats SA calculates the CPI and PPI on a base year and every few years they change the base year. The base year for the CPI at the time this study was conducted was 2008, previously it was 2000 and before that it was 1995. Stats SA provides a conversion factor to change the indices from the current base year to the equivalent indices for the previous base year. As we would like to determine the change from 2001 onwards, it was decided to use the year 2000 as the base year for the CPI in this study.

This means that for the CPI we would need to utilise the conversion factor to convert the newer CPI indices from the 2008 base year (where 2008 = 100) to the 2000 base year (where 2000 = 100).

Presented in Table 1 is the conversion factor for determining CPI Indices for the nine provinces from the 2000 base year (where 2000 = 100) to the 2008 base year (where 2008 = 100), where the provinces are listed by their initials.

Table 1: Conversion Factor for Determining the CPI Indices from the 2008 Base Year to the 2000 Base Year

	2000: 2008	2008 : 2000
WC	0.6085	1.6433
EC	0.6067	1.6483
NC	0.5895	1.6965
FS	0.6478	1.5438
KZN	0.6157	1.6242
NW	0.6147	1.6269
GP	0.6176	1.6191
MP	0.5917	1.6899
LP	0.6257	1.5983

Presented in Table 2 is an example of how the conversion factor for determining CPI Indices from one base year to another, for the 2000 base year to the 2008 base year (and visa-versa). In effect to convert a CPI index from the 2008 base year (where 2008 = 100) to the 2000 base year (where 2000 = 100), simply multiply the CPI indices for 2008 base year by the Conversion factor (1.6191) to get the equivalent indices as per the 2000 base year.

Table 2: Using the Conversion Factor for Determining the CPI

Base Year A : Base Year B	Conversion Factor	Effective Index Base Year A	Effective Index Base Year B
2000 : 2008	0.6176	100	61.76
2008 : 2000	1.6191	100	161.91

The base year for the PPI at the time of this study was conducted was 2000, which means that there were no issues with regards to converting the indices data from one base year to another, for the period being examined (i.e. the municipal financial year of 2001/02 to 2011/12).

3.2.2 CPI - Labour Index

The Labour Index is taken as the CPI according to urban area that is published by Stats SA in their monthly Statistical release P0141.1 Consumer Price Index publication. The CPI index values are published for each province in the "Consumer Price Index and Percentage Change According to Urban Area Table" in publication P0141.1 is taken as the Labour Index for each province (as required by the expression in Equation 1). It should be noted that the format of Stats SA, Statistical release P0141.1 Consumer Price Index has changed over the years. This means that the Table in Stats SA, Statistical release P0141.1 Consumer Price Index for determining the Labour Index values changed. Between January 2001 to December 2006 the data for the Labour Index could be found in Table 21, titled "Consumer Price Index and percentage change according to urban area"; then between January 2007 to December 2008 the data for the Labour Index could be found in Table 7.1, also titled "Consumer Price Index and percentage change according to area"; and then in January 2009 onwards the data for the Labour Index can be found under Geographic Indices and CPI per Province in Table A, titled "Consumer Price Index: Indices and percentage changes".

Furthermore in 2001 the CPI provincial data for the Limpopo Province was presented under Northern Province. An average of the provincial indices was calculated to provide an indicative Labour Index for the whole of South Africa. The Labour Index data was collected from Stats SA from January 2001 to September 2012, from Stats SA's monthly Statistical release P0141.1.

Considering that municipal infrastructure valuations tend to coincide with the municipal financial year, an average Labour Index for the municipal financial year was determined by averaging the Labour Index values for each month of the municipal financial year (i.e. July to June). This was calculated for the municipal financial year from 2001/02 to 2011/12, the results are presented in Table 3.

Table 3: Labour Index Values per Province for each Financial Year

Municipal Financial Year	WC	EC	NC	FS	KZN	NW	GP	MP	LP	ZA
2001/02	110.4	109.8	110.7	107.8	109.6	108.9	108.9	109.9	109.2	109.5
2002/03	122.8	123.1	123.3	116.9	121.8	120.6	121.3	122.5	120.2	121.4
2003/04	123.9	124.8	125.1	119.1	123.8	123.0	122.2	125.1	120.4	123.1
2004/05	127.0	128.3	129.0	122.2	126.3	125.8	125.7	128.8	123.2	126.3
2005/06	131.5	133.6	135.0	127.3	130.6	131.9	130.4	134.4	127.3	131.3
2006/07	140.2	142.2	144.1	134.2	139.7	138.6	139.1	143.9	136.3	139.8
2007/08	154.6	154.9	157.2	145.2	153.5	153.0	153.3	159.2	151.0	153.5
2008/09	171.3	172.9	176.4	160.9	170.6	170.3	168.6	177.7	167.3	170.7
2009/10	180.9	181.2	185.4	169.3	178.0	178.3	177.6	186.9	173.9	179.1
2010/11	187.9	189.0	192.2	176.9	183.7	184.7	184.3	193.9	180.4	185.9
2011/12	198.5	202.0	206.3	188.3	194.7	196.2	194.7	206.0	191.4	197.5

In Table 3 the provinces are listed by their initials and the ZA refers to the average value calculated for the whole of South Africa.

Table 4: Plant Index, Material Index and Fuel Index Values for each Municipal Financial Year

Municipal Financial Year	Plant Index	Material Index	Fuel Index
2001/02	125.8	112.4	121.5
2002/03	145.2	126.3	127.3
2003/04	135.8	137.2	111.1
2004/05	133.0	153.4	144.5
2005/06	135.6	160.3	190.5
2006/07	145.9	170.6	232.5
2007/08	157.4	185.8	336.0
2008/09	183.9	214.7	323.7
2009/10	188.9	212.0	277.0
2010/11	186.9	214.6	333.0
2011/12	188.9	224.0	404.2

3.2.3 PPI - Plant Index, Material Index and Fuel Index

The Plant, Material and Fuel Indices used in Equation 1 are specific PPI values that are published by Stats SA in their monthly Statistical release P0142.1 Consumer Price Index publication.

The Plant Index is taken as the "Civil Engineering Plant" index as published in Table 12, titled "Producer Price Index for Selected Materials', of the Statistical News Release P0142.1.

The Material Index is taken as the "Civil Engineering" index as published under Building and Construction in Table 11, titled "Producer Price Index for Materials Used in Certain Industries", of the Statistical News Release P0142.1.

The Fuel Index is taken as the "Coast and Witwatersrand" index as published under Diesel Fuel in Table 12, titled "Producer Price Index for Selected Materials", of the Statistical News Release P0142.1.

The Plant Index, Material Index and Fuel Index data was collected from Stats SA from January 2001 to September 2012 from Stats SA's monthly Statistical release P0142.1.

Similarly to the Labour Index an average Plant Index, Material Index and Fuel Index for each municipal financial year was determined by averaging the Labour Index values for each month of the municipal financial year (i.e. July to June). This was calculated for each municipal financial year, from 2001/02 to 2011/12, the results are presented in Table 4.

3.3 The Coefficients

The coefficients used in Equation 1 are generally pre-defined and stated in the contract for the civil engineering works. The sum of the four coefficients are required to add up to unity. The CIDB and the SAFCEC publish guidelines for the coefficients. The coefficients recommended in the February 2009 guidelines obtained from the SAFCEC website, as published by the CIDB under the "Compiler Guidance Note - Component document: C1.2 - Contract Data" (CIDB 2009) are presented in Table 5.

A simple statistical analysis of the figures presented in Table 5 is presented in Table 6.

From Table 5 it can be seen that majority of the work categories (1, 2, 3a, 3b, 4, 5 and 6) are readily associated with Roads and Stormwater infrastructure, although work categories 1 and 6 could also be found in other service sectors of municipal infrastructure (such as Water, Sanitation, Solid Waste and Operational Building etc.). Work categories 8 and 9 would be associated with Water and Sanitation and work category 7 can be associated with buildings.

Although the work categories provided by the CIDB coefficients table seem to be dominated by the construction of roads, which tends to account for only a part of the total municipal infrastructure value, it is possible to identify work categories that could be grouped into broad classes of municipal infrastructure. In a typical municipality, the value of the Roads and Stormwater assets generally accounts for around 30% of the total value of the municipal assets and Water and Sanitation infrastructure assets together can typically account for up to 30% of the total value of municipal infrastructure assets. This leaves about 40% of the total value of municipal assets that would comprise of Operational Buildings, Community Facilities, Public Amenities, Solid Waste and Electrical infrastructure assets. Using these guidelines based on the authors experience of municipal infrastructure and in particularly the typical composition of municipal infrastructure in terms of value, a weighting factor was assigned to each work category in Table 5 order to provide a more representative measure of the value of infrastructure associated with municipalities.

Table 5: Guidelines for the Coefficients for the Contract Price Adjustment as published by the CIDB

No.	Work Category	Labour	Plant	Materials	Fuel
1	Bulk Earthworks	0.1	0.65	0.05	0.2
2	Earthworks (with culverts and drainage)	0.15	0.5	0.2	0.15
3a	New Road Construction: National Provincial Roads	0.15	0.35	0.35	0.15
3b	New Road Construction: Urban Roads	0.25	0.15	0.55	0.05
4	Township Roads and Services	0.2	0.25	0.45	0.1
5	Rehabilitation/Resurfacing Works	0.15	0.25	0.5	0.1
6	Routine Maintenance Works	0.45	0.3	0.15	0.1
7	Concrete Works (major structures)	0.3	0.2	0.45	0.05
8	Concrete Works (reservoirs and other general civil engineering works)	0.25	0.15	0.55	0.05
9	Water and Sewer Reticulation	0.15	0.2	0.55	0.1

Table 6: Statistical Analysis of Coefficient Values in CIDB Guideline

Coefficient	Average	Median	Mode	Std. Deviation	Min	Max
Labour	0.215	0.175	0.15	0.103	0.1	0.45
Plant	0.3	0.25	0.15	0.162	0.15	0.65
Materials	0.38	0.45	0.55	0.184	0.05	0.55
Fuel	0.105	0.1	0.1	0.050	0.05	0.2

Table 7: Weighting of Coefficients to Represent Typical Composition of Municipal Infrastructure

No.	Suggested Weighting	Labour	Plant	Materials	Fuel
1	0.07	0.007	0.046	0.004	0.014
2	0.06	0.009	0.030	0.012	0.009
3a	0.06	0.009	0.021	0.021	0.009
3b	0.06	0.015	0.009	0.033	0.003
4	0.05	0.010	0.013	0.023	0.005
5	0.05	0.008	0.013	0.025	0.005
6	0.05	0.023	0.015	0.008	0.005
7	0.26	0.078	0.052	0.117	0.013
8	0.14	0.035	0.021	0.077	0.007
9	0.20	0.030	0.040	0.110	0.020
Total	**1**	**0.223**	**0.259**	**0.429**	**0.090**

These weighting factors were then applied to each work category and the resultant sum for coefficient components are then added to determine a suggested labour, plant, materials and fuel coefficient, these results are presented in Table 7.

The coefficients for the suggested weighting's in Table 7 were then rounded up and down, based on the statistical trends presented in Table 6, to provide the overall recommended coefficients that will be used to calculate the CPA which should be more representative of municipal infrastructure than the figures provided in the guideline (CIDB 2009), the results are presented in Table 8.

3.4 Calculating the Contract Price Adjustment

Utilising the values in Table 3 for the Labour indices, Table 4 for the Plant, Material and Fuel indices, Table 8 for the coefficients, and taking the non-adjustment portion to be 0.1 as per the SAICE guidelines, the fCPA can be determined using the formula in Equation 1. It should be noted that the base year for the calculations will be the municipal financial year of 2000/1 for which all the indices will be taken as 100. The results of these calculations are presented in Table 9.

In Table 9 the fCPA was calculated using the expression in Equation 1; the Effective Value is the nominal value for the asset based on the value

Table 8: Final Recommended Coefficients for Municipal Infrastructure

	Weighting Results	Statistical Trend	Final
Labour	0.223	Lower values	0.20
Plant	0.259	Similar values	0.25
Materials	0.429	Higher values	0.45
Fuel	0.090	Higher values	0.10

Table 9: Contract Price Adjustment Factor Calculated from the 2001/2 to the 2011/12 Municipal Financial Year

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
f_{CPA},	**0.1446**	**0.2714**	**0.2826**	**0.3778**	**0.4622**	**0.5798**	**0.7854**	**0.9819**	**0.9551**	**1.0240**	**1.1518**
Effective Value	1144.61	1271.41	1282.56	1377.82	1462.22	1579.78	1785.39	1981.86	1955.14	2023.98	2151.76
CPA Value	144.61	271.41	282.56	377.82	462.22	579.78	785.39	981.86	955.14	1023.98	1151.76
Base Year % Change	14.46%	27.14%	28.26%	37.78%	46.22%	57.98%	78.54%	98.19%	95.51%	102.40 %	115.18 %
Base Year Multiplication Factor	1.1446	1.2714	1.2826	1.3778	1.4622	1.5798	1.7854	1.9819	1.9551	2.0240	2.1518
Year to Year % Change	14.46%	11.08%	0.88%	7.43%	6.13%	8.04%	13.02%	11.00%	-1.35%	3.52%	6.31%
Year to Year Multiplication Factor	1.1446	1.1108	1.0088	1.0743	1.0613	1.0804	1.1302	1.1100	0.9865	1.0352	1.0631

of the asset in the base municipal financial year (2000/01), which for this study was taken as a nominal value of 1000; the CPA Value represents the difference between in the asset value from the previous year (municipal financial year) to the current year (municipal financial year), taking the value in the base municipal financial year (2000/01) to be 1000; the Base Year % Change is the percentage difference between the value in the municipal financial year from the base municipal financial year (2000/01); the Base Year Multiplication Factor represents the figure that needs to be multiplied to an asset value in the base municipal financial year (2000/01) in order to determine its value in the municipal financial year in question; the Year to Year % Change is the percentage change in asset value from the previous municipal financial year to the current municipal financial year; and the Year to Year Multiplication Factor represents the figure that needs to be multiplied to an asset value in the previous municipal financial year to determine it value in the current municipal financial year.

It should be noted that the values provided for the Base Year % Change and the Base Year Multiplication Factor always refer from the current municipal financial year to the base municipal financial year (2000/01). This means that in order to determine the escalation in value of an asset from the base municipal financial year (2000/01) to the 2009/10 municipal financial year, the value of the asset in the base municipal financial year is multiplied by the Base Year Multiplication Factor of the 2009/10 municipal financial year to provide the value of the asset in the 2009/10 municipal financial year. Similarly to de-escalate from the 2007/08 municipal financial year asset value to the base municipal financial year (2000/01), the value of the asset in the 2007/08 municipal financial year is divided by the Base Year Multiplication Factor of the 2007/08 municipal financial year to determine the value of the asset in the base municipal financial year (2000/01). This also means that in order to determine the escalation/de-escalation from one non base year to another non base year, the value of the asset must first be determined for the base year by dividing the first years asset value by that years Base Year Multiplication Factor, then the value of the asset in the base year must be multiplied by the Base Year Multiplication Factor of the second year to determine the assets value in the second year.

Alternatively the Year to Year % Change and the Year to Year Multiplication Factor provides the step change between municipal financial years. Thus in order to determine the escalation from the 2004/05 municipal financial year to the 2005/06 municipal financial year, the value of the asset in the 2004/05 municipal financial year is multiplied by the Year to Year Multiplication Factor of the 2005/06 municipal financial year to provide value of the asset in the 2005/06 municipal financial year. Similarly to de-escalate from the 2010/11 municipal financial year asset value to the 2009/10 municipal financial year asset value, the value of the asset in the 2010/11 municipal financial year is divided by the Year to Year Multiplication Factor of the 2010/11 municipal financial year to provide value of the asset in the 2009/10 municipal financial year. This also means that in order to determine the escalation/de-escalation from one year to several years before or after, the value of the asset will have to first be escalated/de-escalated each year successively for every year in between the two years. Overall the Year to Year % Change best shows how the asset value changes over the municipal financial years, thus the Year to Year % Change value will be used as the CPA based 'inflation' rate for municipal infrastructure, designated the percentage Contract Price Adjustment (%CPA).

4. COMPARISON OF %CPA TO CPI AND PPI

4.1 Introduction

In order to understand the significance of the value of the %CPA it is best considered in comparison to the headline inflation rates for the CPI (for all items in all urban area in South Africa) and PPI (for domestic output of all industry groups in South Africa). This section details how the CPI and PPI values are determined for each municipal financial year and then a comparison between the %CPA, CPI and PPI is presented.

4.2 CPI

The headline CPI is the CPI determined for all items in all urban area in South Africa, and this is the figure that is widely reported in the media as the %CPI. The headline CPI is published monthly by Stats SA (in their Statistical release P0141.1 Consumer Price Index), but historical records are also available from the Stats SA Website (Stats SA 2012).

The headline CPI figures (both the index and the % change) from January 2000 to September 2012 were obtained from the Stats SA Website. The headline CPI index values obtained were based on the 2008 base year (where 2008 = 100) and these values were converted to the 200 base year (where 2000 = 100) as per the conversion factor in Table 1.

Similarly to the Labour Index, Plant Index, Material Index and Fuel Index that was calculated for each municipal financial year, the Headline CPI (annualised %) was determined by averaging the %CPI values for each month of the municipal financial year (i.e. July to June). Thus an annual municipal financial year %CPI was calculated for the municipal financial years from 2001/02 to 2011/12 along with a multiplication factor and the results are presented in Table 10.

4.3 PPI

The headline PPI is the PPI determined for domestic output of South African industry groups, and this is the figure that is widely reported in the media as the % PPI. The headline PPI is published monthly by Stats SA (in their Statistical release P0142.1 Producer Price Index), but historical records are also available from the Stats SA Website (Stats SA 2012).

The headline PPI figures (both the index and the % change) from January 2000 to September 2012 were obtained from the Stats SA Website. The headline PPI index values obtained were based on the 2000 base year (where 2000 = 100). Similarly to the Labour Index, Plant Index, Material Index and Fuel Index that was calculated for each municipal financial year, the Headline PPI was determined by averaging the %PPI values for each month of the municipal financial year (i.e. July to June). Thus an annual municipal financial year %PPI was calculated for the municipal financial years from 2001/02 to 2011/12 along with a multiplication factor and the results are presented in Table 11.

Table 10: Annual Municipal Financial Year %CPI from 2001/02 to 2011/12

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Annual %CPI	5.58%	10.41%	1.65%	2.63%	3.82%	5.93%	9.24%	10.18%	5.65%	3.85%	5.85%
Multiplication Factor	1.05575	1.10408	1.0165	1.02633	1.03817	1.05933	1.09242	1.10175	1.0565	1.0385	1.0585

Table 11: Annual Municipal Financial Year %PPI from 2001/02 to 2011/12

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Annual %PPI	10.53 %	9.01%	0.75%	3.16%	4.84%	11.09 %	11.47 %	9.14%	1.36%	6.76%	8.64%
Multiplication Factor	1.1053	1.0901	1.0075	1.0316	1.0484	1.1109	1.1147	1.0914	1.0136	1.0676	1.0864

4.4 Comparison of Inflation Indices

In Section 3.4 the annual (based on the municipal financial year) %CPA was calculated, in Section 4.2 the annual (based on the municipal financial year) % headline CPI was determined and in Section 4.3 the annual (based on the municipal financial year) % headline PPI was determined for the 2001/02 to 2011/12 municipal financial years. These figures are presented in Table 12 and allow a comparison to be made of the %CPA against the two headline inflation indices the CPI and PPI.

In general it can be seen in Table 12 that the %CPA follows a similar trend to the headline CPI and PPI figures, although the %CPA is often an extreme value (either above or below) both the CPI and PPI and this is presented graphically in Figure 1. This suggests that there is a sound basis for using the %CPA value rather than the CPI or PPI values usually used to account for inflation in the value of infrastructure as the %CPA tends to provide significant variances against the other two measures of inflation.

Table12: Comparison between Calculated Annual %CPA, CPI and PPI, based on Municipal Financial Years

Inflation Index	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
CPI	5.58%	10.41 %	1.65%	2.63%	3.82%	5.93%	9.24%	10.18 %	5.65%	3.85%	5.85%
PPI	10.53 %	9.01%	0.75%	3.16%	4.84%	11.09 %	11.47 %	9.14%	1.36%	6.76%	8.64%
%CPA	14.46 %	11.08 %	0.88%	7.43%	6.13%	8.04%	13.02 %	11.00 %	-1.35%	3.52%	6.31%

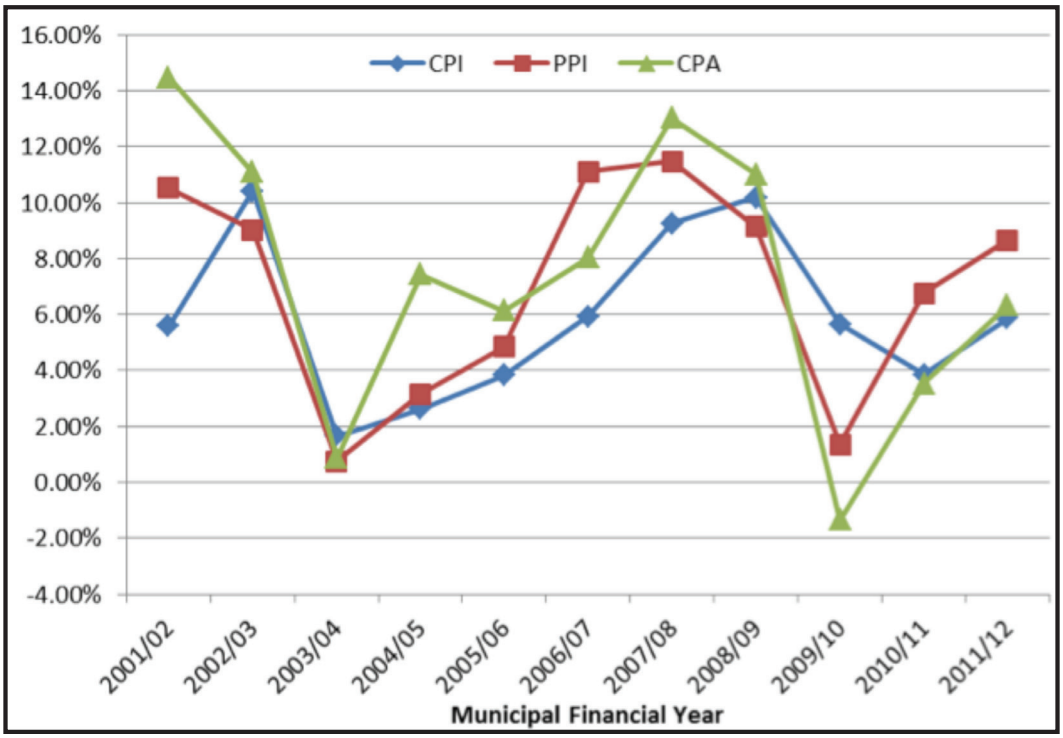

Figure 1: Calculated %CPA, Headline CPI and PPI form the 2001/02 to 2011/12 Municipal Financial Years

5. CONCLUDING REMARKS

In this paper the formula for calculating the price escalation for civil engineering construction works developed by SAICE was utilised to calculate an annual percentage inflation based on the municipal financial year, the %CPA, for municipal infrastructure that is based on the more representative inflation in the civil engineering construction industry from 2001/02 to 2011/12.

The %CPA has been compared against the headline CPI and PPI figures (also based on the municipal financial year) and these results are presented in Table 12 and shown as a graph in Figure 1.

It is recommended that when determining the escalation or de-escalation in the value of municipal infrastructure over the municipal financial years that the %CPA figure is used, rather than the CPI or the PPI, as it is based on the inflation that would have been experienced in the civil engineering construction industry from which municipal infrastructure is created and therefore will provide a more representative estimate of the inflation incurred by municipal infrastructure.

The tool presented in this paper will assist Municipalities by providing them with a means to determine the value of infrastructure, at a particular date, in a consistent, easier and more cost effective manner, which in turn should enable Municipalities to better understand the budgetary requirements they will need to maintain and operate their infrastructure in order to provide the services needed by their communities.

Furthermore as Municipalities are obligated to provide accurate account of their infrastructure assets in their annual reports to the AG, the tool presented in this paper provides a method for determining infrastructure values, at any base date, in an easy, consistent and affordable way (as it avoids the huge costs associated with maintaining and updating a database of infrastructure costs). Thus reducing the burden on Municipalities in meeting their legislative obligations, by reducing the time and cost of determining appropriate time related infrastructure values for their asset registers.

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